New Particle Theory

beyond Standard Model

— Dream of Einstein —

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Introduction

The standard Model (SM) has two unsolved problems. One is source of gauge-groups: $SU_C(3) \times SU_L(2) \times U_y(1)$ and a conservative charge of each gauge-group. The other is source of three generations of matter (lepton, quark) fields interacting with these gauge fields and hierarchy structure of mass characterizing three generations.

Former problem is related with unifying three gauge-coupling constants, latter one is related with 13 Yukawa-coupling constants and a constant of vacuum expectation value. Large symmetry groups: SO(10) including three gauge-groups in the standard model, etc. give one solution of former problem. SO(10)-group has tensor representation constructed by 5 helicity states: 3 states of 5 ones correspond to color quantum numbers and remained 2 states correspond to $SU_L(2) \times U_y(1)$-EW quantum numbers. And then, color charges and electric ones are defined. However, these theories have no solution of latter problem.

There is another problem other than these two ones, that is, the standard model does not include gravity fields. Unifying gauge-fields theory and gravity-fields one is a remained big problem. On one hand, (2n+2)D-spinor representation give representation characterizing bosons fields with integer-spin at which n is even number and fermions fields with half-integer-spin at which n is odd one.

In this book, new particle theory, which includes SM and has solutions of above problems, is proposed. Particle fields are constructed by using spinor representation of multi-dimensions and by symmetry of 4D-time & space. Gravity fields which are not included in SM are constructed by the spinor representation naturally. The representation has potential to unify four interaction forces.

Canonical quantization of vector gauge fields with (2n+2)D-spinor

representation is expanded to quantization of gravity-gauge fields. In this process, we find that a new conservative charge could exchange at interaction of matter-doublet fields. The new discovered charge is named a "Mass-charge". On one hand, constructing hierarchy structure of matter fields by using (2n+2)D-spinor representation at n = 1, 3, 5 (odd numbers), each generation's matter (quark and lepton) fields has a characteristic "Mass-charge". Taking a "Mass-charge" of electron or t-quark as a standard one, all mass of quarks and charged leptons are obtained without any Yukawa coupling constants. Exchange of "Mass-charges" between generations is related with 3 generations mixing of quarks or neutrino vibrations, then, we have mixing angles from "Mass-charges" and their exchanging probability respectively.

This book has three parts. In part Ⅰ, every elemental particle is constructed by using (2n+2)D-spinor representation and symmetry of 4D-time & space. Fermions are given at n= 1, 3, 5 (odd numbers), and bosons including scalar fields are given at n= 0, 2, 4 (even numbers). Each particle has 4D-Lorentz invariant quantum free fields, by taking 4D-time & space which is a vessel of itself as effective action space.

In the first half of part Ⅱ, 4D-Lorentz invariant quantum free fields with (2n+2)D-spinor representation are canonically quantized. Gauge-invariant interaction terms are represented unifying by covariant differential, and the Lagrangian is constructed. The Lagrangian of Einstein's gravity theory is obtained by classical approximations of the Lagrangian of gravity-gauge fields based on unified ones.

In the last half of part Ⅱ, gauge fields are quantized by BRS-T method which is gauge-independent. Expanding quantization of non-Abelian-gauge fields, spin and affine connections which construct gravity-gauge fields are quantized. Then, these vacuum structures are made clear. These structures give restricted conditions for gauge-phase between two connections, which could be a source of new conservative charge "Mass-charge".

In the first half of part Ⅲ, we obtain three generations' mass of charged-leptons and quarks by using the "Mass-charges". Each

mass-term of them is represented by “Mass-charges” and each mass is calculated by a ratio of electron’s Mass-charge. 6 quarks’ mass are agreed with data-bases in upper and lower limit, and charged leptons’ mass are several % larger than data-bases. This shift of charged leptons’ mass could be canceled by effects of neutrino vibrations.

In the last half of partⅢ, we obtain three generations mixing of quarks and neutrinos by using “Mass-charges”. Generations mixing mean an exchange of “Mass-charges” which particles have before and after transitions. A transition probability is defined by exchanging of “Mass-charges”, and elements of mixing matrix are represented. Applying to mixing matrix of quarks, we find that the exchange probability has relation with total number of exchanging “unit-Mass-charges”. A mixing matrix of neutrinos is calculated without using data-bases of neutrino vibrations, because restricted conditions are obtained by a reverse process of charged leptons’ mass corrections.

When I am preparing this book, I have new information of T2K neutrino’s experimentation. This result of θ_{13} is agreed fairly good as well as other mixing angles: θ_{12}, θ_{23}. Which shows that a discovery of “Mass-charge” and results of partⅢ: mass terms’ representation of three generations and mixing matrices’ ones of quarks and neutrinos, and mass corrections of charged-leptons, etc. have good rightness.

The good results of partⅢ support theory and development of part Ⅰ and part Ⅱ, that is, support particle fields represented by multi-dimensions spinor and symmetry of 4D-time & space, hierarchy structure of three generations’ matter fields with (2n+2)D-spinor at n = 1, 3, 5, and structure of scalar, vector-gauge, color-vector-gauge, and gravity-gauge fields with (2n+2)D-spinor at n = 0, 2, 4, and quantization of these particle fields. And we come close to theory of unifying four interactions forces including gravity fields.

October, 2013

Seiko Kono

Introduction for Publication of English-Version

When I was preparing publication of the Japanese-version, results of T2K neutrino vibration's experimentation had been published. The results agree well with calculation results of chapter 4 in the partⅢ-2. This agreement supports rightness of "unit-Mass-charge" which is the kernel of this book. Then, comparing of mixing angles of neutrino's vibration between calculations and T2K observations are revised in this English-version. Furthermore, several mistakes and errors in the Japanese-version had been corrected.

December, 2014

Seiko Kono

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Part I　Structure of Spinor Fields (Particle Fields) and Symmetry

In part I , new elemental particles' structures are drawn based on spinor fields (fermions and bosons) and symmetry of 4D-time & space.

Spinor fields which have larger dimensions' representation and larger spin are constructed. Each particle fields with (2n+2)-dimensions (D)-spinor representation has symmetry of its spinor dimensions by spinor (or supper-symmetry) generators acting on a vacuum. Matter fields are constructed at n= 1, 3, 5 (odd numbers), and boson fields including scalar fields (or Higgs ones) are constructed at n= 0, 2, 4 (even ones). Each particle has 4D-Lorentz-invariant quantum free fields by taking 4D-time & space which is a vessel of itself as effective action space. Following relation of groups: $SU(2) \times SU(2) = SO(4)$ acts an important role.

In chapter 1, spinor and supper-symmetry algebras are reviewed. From the 2nd to 6th chapters, particle fields having larger spin: scalar, matter, vector boson, and metric tensor fields are constructed step by step as piling blocks. And symmetry of each fields is studied.

In chapter 3, quarks and leptons are distinguished, and the 1st, 2nd and 3rd gen. matter fields are distinguished, which are not able in the Dirac field representation. Color-symmetry acts an important role for the hierarchy structure of matter fields. In chapter 4, neutral or charged vector boson fields are constructed, following with different helicity states of a vacuum on which these generators act. In chapter 5, color vector fields are constructed. The fields have not same spinor representation as vector boson fields, but have same one as metric tensor fields. Color vector fields and quark/lepton fields have strong relation of color-symmetry. In the last chapter 6, metric tensor fields are constructed. The fields have neutral color-symmetry, however, have same Lorentz-representation as color vector fields. Then, gravity fields are constructed by spin connection with vector type representation and affine connection with anti-symmetry tensor type one.

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